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NUTRITION IN GERIATRICS

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NUTRITION IN GERIATRICS

"Aging is a part of living. All living matter ages and as it ages, changes. Aging involves every one of the innumerable aspects of life. It begins with conception and ends only with death. Thus, growth, development and maturation are just as much consequences of the occult process of aging as are the atrophies and degenerations of senility. Evolution and involution are both affected by aging; pediatrics and geriatrics are closer than many realize. Gerontology is the science of aging in the broadest sense. The aged and aging are not the same; the aged are people, aging is a process. Whereas pediatrics is concerned with the early stages of the life span, geriatrics is that branch of medical science concerned with the physiologic and pathologic problems of older individuals. Geriatrics is thus but a part, a subdivision of the broader field of gerontology."—Stieglitz, *Geriatric Medicine,* Saunders Company, 1943.

Geriatrics is a relatively recent branch of medical science. The greatly increased expectancy of life and the large predominance of elderly people in our present population have stimulated an interest in the problems of the aged which has hitherto been almost completely lacking. At the time of the Roman Empire life expectancy at birth was approximately 23 years. During the next 19 centuries the average rose very slowly, reaching an expectancy of 40 years by 1850 and 47 years by 1900. Following the turn of the century, the rise has been dramatic, life expectancy increasing to about 63 years by 1940. The increase in the brief period from 1900 to 1940, thus, almost equalled that for the preceding nineteen centuries. In 1900, 17 per cent of the population of the United States was 45 years or older; by 1940 the number of persons over 45 rose to 26.5 per cent. The number of persons now over 65 in this country (approximately nine million) has increased at a rate almost five times the increase in general population rate.

As Stieglitz (1) points out, the present situation is without precedent. In earlier centuries, wars, famine and pestilence have caused severe shifts in population structure but always in the direction of relative increase of youth. Improvements of modern civilization and advances in medical science, however, have tended to extend the life of the less hardy, so that along with the increase in longevity is the problem of maintaining the health and usefulness of the new millions of the aged.

The phenomenal development of the science of nutrition in the past three decades and particularly the outstanding achievements of the past few years offer one of the most promising means of attaining the ultimate goal of geriatrics as defined by Piersol and Bortz (2): "The society which fosters research to save human life cannot escape responsibility for the life thus extended. It is for science not only to add years to life, but more important, to add life to the years."

Nutrition in Geriatrics:

The role of nutrition in geriatrics is a dual one. In addition to providing information with respect to the specialized food needs of persons in advanced age groups, a knowledge of the nutritional requirements of individuals in the middle age groups can be expected to contribute markedly to the retardation of senescence and its attendant diseases. Just as great advances have been made in recent years in the care of infants and children through the scientific understanding of their nutritional needs, it is to be hoped that a similar understanding of the nutritional requirements of older people will bring about comparable advances in geriatrics.

The problems of geriatrics begin far earlier than actual chronological old age. Aging itself begins in intra-uterine life; in fact, the most marked and rapid manifestations of the aging process occur in infancy and youth. The nine months old infant, for example, has already doubled his birth age. As the years progress, the rate of aging decreases slowly. Thus it is apparent that if the ultimate effects of senility are to be modified, prophylactic measures must be begun long before the approach of advancing years. The science of pediatrics takes care of the early phases of aging; geriatrics must be concerned with man in the meridian of his life–about forty years of age–if it is to be effective during the senescent years after seventy. Nutrition as a factor in geriatric medicine must therefore begin with the needs of the mature, pre-senile individual.

Nutrition and Life Span: The general nature of the diet exerts a profound influence on vitality and longevity. Examples of such influence in human population groups have frequently been cited by trained observers. Typical of these reports is that made by McCarrison as director of the Nutrition Research Laboratory in Coonoor, India (3). He found the Hansa, a tribe living high up in the Himalayas on a diet consisting largely of goat's milk, eggs, whole grains and fruits, including liberal amounts of apricots, to be so vigorous and so free from diseases of nutritional origin that they live to an age not attained by the people in other areas of India, who subsist largely on cereals and legumes and who, even in childhood, manifest signs of nutritional deficiency. He remarks that, "Their longevity and fertility were matters of such concern to the ruling chief that he took me to task for what he considered to be my ridiculous eagerness to prolong the lives of the ancients of his people." Similar conditions are reputed to exist among the pastoral peoples of the Balkans, particularly in Bulgaria, where a sizeable portion of the population subsisting on dairy foods, particularly cultured milks, is said to attain 100 or more years of age.

In the case of experimental animals, studies of many generations have repeatedly shown that increasing the amounts of protective foods over the amount already sufficient for normal growth markedly increases the life span of the animals and extends the period of vigorous activity and health well into old age. According to Sherman, (4) on the basis of extended animal studies, "The same degree of incipient senility which is reached by normal individuals on the 'adequate' diet at an age corresponding to about 65 years in the human life is deferred to an age corresponding to 75–80 years on the nutritionally improved diet."

In addition to the general nature of the diet from the point of view of an adequacy of the protective foods, there is some evidence that the quantitative nature of the diet may considerably influence life span. Undereating and overeating both constitute important problems. Of the two, overeating is regarded as perhaps the more serious, since overweight and obesity have been shown to be detrimental to long life and to favor the development of disease in later life. According to life insurance statistics, underweight also tends to shorten the life span of man. That it may not be as serious a factor as overweight, however, is hinted at in the well-known animal experiments of McCay (5). He found that the feeding of a diet nutritionally adequate in all respects except for caloric restriction so severe as to prevent the animals from attaining normal growth resulted in a significant prolongation of the life span of these animals. Although some of these retarded animals exceeded the life span of a normal rat by about 50 per cent, they never reached maturity. The advantage of increasing length of life at the expense of growth and maturation is somewhat dubious. The full significance of these experiments, however, is yet to be clarified and the implications with respect to human life processes necessarily remain in the realm of the speculative. With respect to the human diet during old age, however, it may be pointed out that the habit of undereating constitutes a fallacious and harmful procedure, since it results in serious nutritional deficiencies, frequently at a time when they are least able to be tolerated.

Nutritional Requirements of the Aged:

General Principles: Assuming that the individual has heeded the advice of nutritionists during the early and middle years of life, he will have been subsisting on a diet providing adequate amounts of milk and other dairy products such as cheese, ice cream, etc., citrus fruits, other fruits; green and yellow vegetables; potatoes; eggs; meat, poultry or fish; whole grain cereals and enriched breads; butter or

fortified margarines. In terms of specific nutritional essentials, such a diet would provide daily for the average, sedentary man (154 lbs.):

Protein	70 grams
Calcium	0.8 gram
Iron	12 milligrams
Vitamin A	5000 I.U.
Thiamin	1.5 milligrams
Ascorbic Acid	75 milligrams
Riboflavin	2.2 milligrams
Niacin	15 milligrams

As far as is known at present it is believed these essentials should be supplied daily in approximately the same amounts in diets for the aged. In preparing diets for the aged, however, it is especially important that an adequate intake of vitamins, minerals and protein be supplied since the caloric intake is likely to be lessened in accordance with restricted activities in order to prevent obesity. Because of the more limited nature of the foods selected resulting from personal idiosyncrasies, digestive difficulties, poor teeth, and other factors, the likelihood of an adequate diet being ingested is further decreased. For these reasons, fortified or enriched foods play a particularly important role in the diet. In special instances, however, supplementation with vitamin, mineral or protein preparations may be necessary.

In order to insure the taking of an adequate, well-balanced diet by the aged, particular attention should be given not only to the foods selected, but to the manner in which they are prepared. Because of dental or digestive impairment it may be necessary to mash or grind the foods. A waning appetite or lack of interest in food may be combated by thoughtful selection and attractive serving of foods.

Specific Requirements: As has already been indicated, the nutritional standards set up for the average healthy adult apply, with but slight modification, equally as well to the older individual. Calories in the form of fats and carbohydrates may be lessened to conform to changed energy outputs.

(Fats and Carbohydrates): Fatty livers and hardening of the arteries, conditions likely to be encountered with advancing years, are considered by many investigators to be the result of a diet excessively rich in fats and cholesterol (6). Recent experimental work with animals (7, 8, 9, 10) has shown that a certain type of fatty liver cirrhosis can be induced by a faulty diet and prevented, to a large extent, by adequate amounts of dietary choline or the milk protein casein. Successful dietary treatment of human liver cirrhosis has been reported by Patek and Post (11) using a high protein, moderate fat and vitamin B complex-rich diet. There is considerable controversy as to the exact role of diet in the etiology of arteriosclerosis, but much evidence

has been presented which shows that, both under experimental conditions and clinical conditions existing in modern times, foods rich in cholesterol and high fat diets have increased the incidence of this disease as well as of diabetes and certain heart and kidney disorders (6).

With respect to excessive ingestion of carbohydrates, clinical and experimental studies and statistical reports support the view that overfeeding of these foods may result in degeneration of the insulin-producing cells of the pancreas with resultant diabetes (12, 13). In the aged, therefore, an excessive intake of fat and carbohydrates should be avoided, especially if there are hereditary factors predisposing to these diseases.

(Proteins): Modern medical authorities agree generally that the dangers of a high protein diet have been greatly exaggerated. An adequate protein supply is essential at all times because growth, change and repair occur constantly at all ages in all body tissues. Recent biochemical studies with the aid of isotopes have shown that the constituents of the body are in a constant state of flux and that the composition of supposedly inert structures (teeth, skeleton, muscle, fat deposits) is continuously changing in conformity with dietary intake (14). Adequate protein is vital for maximum efficiency and protection of the liver, both in health and in such diseases as are directly injurious to this vital regulatory organ (15). Under normal conditions, therefore, the protein intake should approximate one gram per kilogram of body weight daily in accordance with National Research Council standards. Any loss of protein through albuminuria, unless counterindicated by other factors, should be compensated for by extra protein. Dietary protein deficiency may be an important contributing factor to ill health in the aged. Severe protein deficiency may be manifested by tissue wastage, anemia and edema; milder deficiencies may give rise to habitual fatigue and early symptoms of these disorders.

For adequately meeting the protein requirement a large proportion of the dietary protein should be derived from animal sources such as liver, visceral organs, other meats, fish, milk, cheese, ice cream, eggs and cereal germ proteins.

(Vitamins): In considering the possibility of vitamin deficiency symptoms in the aged, Sebrell (6) points out the importance of remembering that such deficiencies may occur even in the presence of an adequate intake if any condition is present which interferes with their proper absorption and assimilation. Such conditions may include diarrhea, colitis, vomiting, achlorhydria and metabolic disorders likely to accompany advancing years. Under such circumstances vitamin supplementation through special preparations or, in

severe cases, even parenteral injection may be necessary *in addition to a well-planned adequate diet.* The importance of an adequate and varied diet in all cases cannot be overstressed since it is the basis of prophylactic as well as therapeutic treatment, whereas vitamin supplementation must be regarded more as a temporary, emergency measure. Because lack of appetite and interest in eating are all too common in old age, it is especially important that the habit of a good diet be stressed and cultivated.

In addition to their usual functions, certain of the vitamins may have special significance in connection with some of the disorders associated with old age. Insufficient vitamin A may result not only in night blindness*, but in a dry, scaly condition of the skin, particularly of the arms and legs. Yellowish patches known as Bitot's spots may also develop in the cornea of the eye, (16) and general resistance tends to be lowered.

Thiamin deficiency merits especial consideration in the aged because in advanced stages the characteristic symptoms such as enlarged heart and swelling of the extremities may create a misleading picture of cardiac disease. Thiamin deficiency may be distinguished from heart disease by such signs as the loss of ankle jerks, painful calf muscles and enlargement of the right side of the heart. Milder degrees of thiamin deficiency may be manifested by vague muscle pains, particularly of the calves.

Vitamin C is markedly decreased in the tissues and fluids of the aged and its deficiency is manifested in the usual symptoms of swollen, spongy or bleeding gums, capillary fragility and a tendency to hemorrhage into the skin following very slight injury.

There are two manifestations of niacin injury, in addition to the usual picture of pellagra, which are of special importance in old age. One is a very mild condition, often overlooked, characterized by a smooth, reddened tongue with or without digestive disturbances and a minimum of skin lesions. The other is described by Sebrell (6) as a severe degenerative disease of the brain in which there are no skin disturbances and the patient is stuporous or disoriented and confused and may have hallucinations, "cogwheel" rigidities and sucking reflexes, thus presenting a picture similar to a toxic psychosis or exhaustion delirium. Unless immediate therapy with large doses of niacin is instituted such patients usually die.

Disturbances manifested in the mouth are indicative of riboflavin deficiency as well. The signs include a magenta colored tongue, fis-

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*See Borden's Review of Nutrition Research for December, 1943, "Nutrition and Vision—Vitamin A."

sures in the angles of the mouth and reddened lips. Other symptoms may be seborrheic accumulations on the folds of the body and capillary invasion and opacity of the cornea. These manifestations are not peculiar to the aged, but it is especially important in the aged to avoid confusion of the fissures in the angles of the mouth with similar lesions resulting from poorly fitting dentures or similar causes.

Pyridoxine has been used in a number of clinical cases to overcome weakness and difficulty in walking (17) and to treat certain cases of Parkinson's disease (18, 19). Confirmation of the specificity or effectiveness of this vitamin in treating these disorders is yet to be made, but because of the few instances in which its use has been successful, the trial of pyridoxine therapy has been recommended for what it may be worth.

In the case of vitamin D, deficiency may result in osteomalacia, an adult form of rickets. The disorder is characterized by an increased porosity of the bones, bowing of the extremities and other bony deformities, pains in the ribs, sacrum and legs, emaciation and easy fatigue. Some hope has been extended for the effectiveness of massive doses of vitamin D in the treatment of arthritis, a disease frequently appearing in later years, (20) but this form of treatment is generally regarded as experimental and not without certain dangers.

Vitamin K is important in the aged where liver or gallbladder disease may be present and may result in interference with the flow of bile to the intestinal tract. Because of the lack of bile, there is an impairment of the absorption of vitamin K which prevents the adequate formation of prothrombin, a substance essential to the vital mechanism of blood clotting.

(Minerals): Of the many minerals essential to normal body functioning, only calcium and iron are of special clinical importance with respect to the problems of geriatrics. The diet of the aged is likely to be low in both of these elements, resulting in possible bone weaknesses, delayed healing of fractures, and nutritional anemia. Adequate provision of foods rich in these minerals should therefore be an important dietary consideration.

Under normal conditions of health, the vitamin and mineral requirements of the aged are believed to be the same as those for the young adult. It is expected, however, that future research will develop more specific information concerning these requirements. Where disease or other factors interfere, special high dosage with vitamin and mineral supplements is indicated. A guide to such dosage has been given by Sebrell (6).

Experimental Studies:

A limited number of experimental, clinical studies have been carried out concerning the significance of various nutrients in the diet of the aged. General observations made by Kay (21) on 700 elderly people in institutions indicate that many of these people exhibited obvious or hidden vitamin deficiencies despite the apparent adequate nature of the institution diet. It was suggested that poor eating habits, prolonged cooking (to make food soft), diet restrictions due to disease, and decreased ability to utilize the vitamins may have been important contributory factors. The incidence of vitamin deficiency increased toward the end of the winter with the declining supply of fresh fruits and vegetables and available sunshine.

Kay's experiment was conducted with 75 elderly patients of whom 25 exhibiting overt deficiency symptoms were selected for treatment with multivitamin preparations. Of the patients who received the vitamins, none had any acute respiratory diseases from the end of January to the middle of June, whereas of the 50 controls, five developed influenza, two had bronchial pneumonia and many others had colds. The vitamin-treated patients almost all showed improved appetite and weight gain.

A group of British investigators, Stephenson *et al* (22), recently reported results of clinical studies with the B vitamins and ascorbic acid used on a group of senile patients in an attempt to modify, prevent or relieve certain characteristic senile manifestations. They treated 40 patients for about a year and observed 18 untreated elderly patients as controls for the same period. Vitamin C was used because it is present in markedly decreased amounts in the tissues and fluids of the aged; the B complex was used because experimental evidence suggests various members of this vitamin group may have some influence on such signs of age as the graying of hair, loose, wrinkled skin, sparse hair, adrenal atrophy and emaciation of the skin. Treatment was divided into five periods: a "pre-treatment" period, a "post-treatment" period and three intermediate periods. During the first of these, half of the treated patients received the B complex and the other half, vitamin C. This was reversed in the next period. During the following period both supplements were fed simultaneously. During the "vitamin B periods" 43% of so-called senile manifestations* were relieved, whereas only 7% improvement was noted among the controls. Similar results were obtained during the "vitamin C" period. When both B complex and vitamin C were given simultane-

*Senile manifestations were considered to be: impaired mental condition, shuffling gait, uncertain movements, tremor in the hands, stiff joints and limited mobility, shortness of breath, edema of the ankles and eye sacs, easy chilling, skin rashes, itching, insomnia and constipation.

ously there was a 70% improvement in senile manifestations in the treated group compared with 7% in the control group. The authors conclude that:

> "In spite of the comparatively limited and modest results which aged people might expect from treatment with vitamins, it seems clear that in suitable cases the relief obtained in some pathological senile features might be considerable."

Other investigators have approached the vitamin problem from the point of view of special requirements of the aged. Significant vitamin retention and excretion studies along these lines have been conducted by Rafsky and Newman. In one of their preliminary studies (23), they investigated the vitamin C status of 25 supposedly "normal" aged persons. They determined blood ascorbic acid levels one hour after the noon meal and urinary excretion after 24 hours. Using these levels as controls, increasing dosages of vitamin C were administered until saturation was obtained. All the subjects, though varying in degree of response, showed very high retention of the vitamin, only two reaching saturation easily, while about one-third never reached saturation at all. This indicated a high requirement of vitamin C for this group of persons, or at least, a very low reserve of the vitamin in the blood and tissues.

In a subsequent study (24) on thiamin, even more striking results were obtained. Twenty-two persons between ages of 63 and 89 receiving a diet apparently adequate in thiamin served as subjects. Nevertheless unusually large amounts of the vitamin had to be administered before saturation could be obtained. The authors suggest that the thiamin requirement for individuals in this age group may be higher, possibly as a result of impaired absorption of the vitamin.

Rafsky and Newman (25) have also postulated an increased niacin requirement in connection with the relatively common occurrence of porphyrinuria (excretion of abnormal pigments in the urine) in the aged. They were able to check the occurrence of porphyrinuria in all of 55 patients treated with varying dosages of niacin, whereas no such check was possible in control subjects receiving other B vitamins or vitamin C. The authors suggest the corrective action of niacin may have been due to its improving the function of the liver which is commonly impaired with age.

Dietary Suggestions:

The following suggestions, adapted from Tuohy (15) offer a general guide to the diet for the aged:

1. Elderly people should start the day with a good breakfast. It should include some substantial protein, and whatever else depends on body weight and activity. Protein adequacy must be maintained at all ages.

2. As a source of proteins, calcium and vitamins, milk and especially cheese are desirable.
3. As effort lessens and sedentary life supervenes, weight rise or fall should dictate the proportion of carbohydrate taken, and as much of this as possible should be from whole grain.
4. For the obese, vegetables and fruits should act as the "fillers" and provide appetite and zest for eating by meticulous preparation and serving.
5. The elderly should eat fat sparingly, even as the middle aged should use it cautiously. The high cholesterol sources (egg yolk, cream and animal fats) should probably be curtailed wherever body build, family history and other indications portend arteriosclerosis. It is the one decisive indication for dietary restriction after full stature has been attained. The danger of high blood cholesterol is not universal.
6. Tea, coffee and alcohol are useful stimulants. The abuse of alcohol places it for some people in the category of both refined carbohydrate and animal source fat.
7. Food and water (hot drink) taken at regular intervals revive the old. Food becomes the best sleep producer even though early wakefulness follows. Fruit juices add the needed vitamin content.
8. Hunger lessens as age advances. Foods useless calorically (condiments, broth, relishes) have a place. The teeth, gastric acidity, probably absorptive powers, vitamin storage—all begin to fail with age. We are able to compensate for these losses with vitamins, iron, calcium, hydrochloric acid and a balanced diet.

Conclusion:

The role of nutrition in geriatrics is only now beginning to be recognized and appreciated. Very little definite information as to the specific needs of the aging and aged—beyond what is already known concerning the requirements of the normal young adult—has accrued in the brief period during which awareness of this problem has arisen. The one certainty upon which nutritionists and physicians agree, however, is the fact that proper nutrition, beginning early in life, and possibly even in prenatal life, is an important and decisive factor in determining the rate and severity of the inevitable degenerative changes of senility. The goal of geriatrics—a goal which proper nutrition can undoubtedly bring nearer realization—is not merely to extend life, but to increase the period of man's vigor and usefulness, to make the so-called "declining years" fuller and more productive. As Stieglitz (1) has said: "Great longevity without health is more than individual tragedy. The increased longevity of man may be made an incalculably valuable advance if health and vigor be retained and the vast potentialities of the now largely discarded elderly be developed. The reward may be the dawning of a new era of intellectual conquest, for man may then live long enough to think."

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NEWS DIGEST

NEW VITAMIN IN CREAM—A dietary factor partially isolated from raw cream has been found to be needed by guinea pigs to prevent development of stiffness in the wrists and elbows and the excessive, indiscriminate deposition of calcium throughout the body. The possible identity of the new antistiffness factor with vitamin E was investigated by giving groups of guinea pigs a vitamin E free diet consisting of casein, dextrin, yeast, salt mixture and orange juice, with supplements of vitamin E and the stiffness factor given separately or together. When the stiffness factor only was lacking, the characteristic stiffness of the wrists developed but no changes occurred in the excretion of creatine. When vitamin E only was lacking, general muscular dystrophy developed accompanied by creatinuria. When both factors were missing, stiffness and muscular dystrophy with creatinuria developed at the same time resulting in severe paralysis. If both factors were added to the deficient diet the guinea pigs did well but did not grow as rapidly as animals on the stock diet. The tests therefore indicate that vitamin E and the antistiffness factor of cream are two distinct entities.—*Arch. Biochem. 3,* 305 (1944).

RIBOFLAVIN IN PASTEURIZED MILK – The riboflavin content, before and after pasteurization, was estimated fluorimetrically in winter milk from Ayrshire, Guernsey, Holstein, Jersey and Milking Shorthorn cows. Twenty-four samples of milk were pasteurized by the spray vat process, 12 by the coil vat process and 10 by the flash process. The average riboflavin contents of the three sets of samples were 1.46, 1.52 and 1.41 mg. per liter before pasteurization, respectively, by the three processes; and 1.43, 1.49 and 1.42 after pasteurization. The data indicate that practically no loss in riboflavin occurs in milk pasteurization. *J. Am. Diet. Assoc. 20,* 226 (1944).

OYSTER SHUCKING—Carbon dioxide intoxication of oysters has been used experimentally to hasten the process of shelling, according to recent reports from government experiments. The oysters, immersed in carbonated water for five minutes, became intoxicated by the carbon dioxide to a point where the large muscle holding the shells closed relaxed and the shells were easily opened. In one test, a novice was able to open 150 treated oysters in twenty minutes, a speed considered difficult even for experienced oyster shuckers to attain with "sober" oysters. It is reported that neither flavor nor quality of the oysters is affected by the carbon dioxide treatment. – *U. S. Industrial Chemical News,* Nov. (1944).

ATABRINE TOLERANCE—Experimental studies with animals indicate that various nutritive factors may possibly have an effect upon toxic reactions to the anti-malarial drug, atabrine. When fed to rats daily at a level of 25 milligrams per kilogram of body weight along with an adequate diet, the drug was without harmful effect on growth, general appearance and behavior, or reproductive capacity. Increasing the level of dosage, however, to 40-65 milligrams per 100 grams of food resulted in retarding of growth and discoloration of the fur. Extra vitamins or proteins in the already adequate diet had no effect in preventing these changes. It was observed, however, that at sub-optimal intakes of riboflavin or protein the toxic effects of atabrine were more severe. At sub-optimal levels of vitamin A intake, on the other hand, no increase in severity of toxic reactions was noted. —*J. Nutr. 27,* 141 (1944).